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Differences of estimated and analysed energy losses with cat urine

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Introduction: The accurate estimation of energy losses with urine are important for the determination of energy requirements based on metabolizable energy (ME) in cats. In practice, urine energy is analysed by bomb calorimetry or estimated by a formula developed by Hofmann and Klein (1980), which is based on data from different animal species, not including cats. The aim of the present study was A) to assess a potential difference in estimating energy losses using the formula from Hofmann and Klein or bomb calorimetry (H_0 : no significant difference in estimated energy losses between the two methods). In part B it was determined if the subtraction of 3.1 kJ/g of protein intake used for estimation of metabolizable energy content of cat foods (Kienzle et al., 1998) can be confirmed as useful.

Material and methods: The data originated from different balance studies (5-7 days) using dry food, home made diets or canned food: Schade (2006): n=11, age (a): 1.3 ± 0.3 years (y), Isenegger (2008): n=6, a: 2 y, Schaufelberger (2008): n=6, a: 2.5 ± 1.2 y, Zottmaier (2008): n=6, a: 2 ± 0.8 y, Signer (2010): n=10, a: 2.1 ± 0 . Trossen (in preparation): n=12, a: 1.3 ± 0.1 y, Wichert (in preparation): n=6, a: 6-7 y. In part A only studies with female cats were included and in part B female and male cats at maintenance aged between 1-4 years. During all experiments the cats were maintained according to the animal welfare legislation of Switzerland. The cats were housed in single stables and food intake, total of faeces and urine were determined. Food (homogenised), faeces and urine (lyophilised) were analysed for gross energy by bomb calorimetry. C and N were analysed with help of a CN-analyser. Food and faeces were also analysed for the crude nutrients. Digestibility and metabolizability of energy were calculated from the analysed data and the energy content of urine was estimated by the following formula: $GE \text{ (kJ) urine} = 33 \text{ kJ} \times g C_{\text{urine}} + 9 \text{ kJ} \times g N_{\text{urine}}$. Statistical analyses using regression techniques (linear and linear mixed models to account for potential clustering within-animal) were performed with the software R version 2.11.1. Model selection was based on AIC (Akaike's information criterion) with lower values indicating a better model fit. Model selection was based on checking visually the residuals for homogeneity and independence.

Results and discussion: The urinary energy content varied between diets and experiments as well analysed (9540.4 ± 125.3 and 11570.1 ± 326.9 kJ/g DM) as estimated (7295.1 ± 548.9 and 15368.1 ± 2608.5 kJ/g DM). A significant difference ($p < 0.0001$) was found between the quantification methods. The range of differences from estimated to analysed accounted for 1 % up to 45 % depending on diet. The mean estimated energy loss via urine/g of protein intake was 3.7 ± 1.2 kJ. Mean daily urinary energy loss/g of protein intake were not significantly different ($p = 0.1176$) from the value of 3.1 kJ/g of protein intake (Kienzle et al., 1998). The urinary energy losses/g of protein intake were significantly associated with crude fat intake ($p = 0.0028$) and diet ($p = 0.0001$).

Conclusion: From the data of the present study it is obvious that the formula of Hofmann and Klein (1980) results in estimated energy losses differing from analysis by bomb calorimetry and does not provide accurate energy loss estimation in all feeding trials. However, the reason for the difference could not be determined from the present data. In practice, the estimation of the ME content of cat food with the subtraction of 3.1 kJ/g protein intake given by Kienzle et al. (1998) is suitable.

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